Student Name: Student id: Serial #:

University of Bahrain College of Information Technology

Department of Computer Science

ICS332: Concepts of Programming Languages FIRST TEST Date: NOV 1, 2005

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QUESTION ONE: Fill in blanks Questions [11 pts]

1) The number of lexemes in a sentence " `index = C*(count+197);` " is _____10_____; the number of different tokens in the same sentence is _____8_____.

2) There are 2 approaches of matching a given goal to facts in a database: FORWARD CHAINING (BOTTOM-UP-RESOLUTION) and BACKWARD CHAINING (TOP-DOWN-RESOLUTION).

3) In _____OPERATIONAL_____ semantics, the change in the state of the machine (memory locations, registers, condition codes and status registers) defines the meaning of the statement.

4) The process of finding useful values for variables in propositions that allows matching process to succeed is called _____UNIFICATION_____.

5) An example of an imperative language is _____C++_____; an example of a scripting language is _____PHP_____.

6) Context-free grammars cannot describe all of the syntax of programming languages. Give 2 examples from the languages you know that cannot be described (or very hard to describe) in BNF: ____TYPE CHECKING____ or ALL IDs MUST BE DECLARED BEFORE USED.

7) Attribute grammar is a context-free grammar plus 3 additions: ___ATTRIBUTE VALUES_____, semantic functions, and _____PREDICATE FUNCTIONS_____.

8) A _____SENTENCE_____ is a string of characters over some alphabet; a sentential form consisting of only terminals or lexemes is called a ____/_____ SENTENCE _____.

9) The left side of the Prolog headed Horn clause statement is called _____CONSEQUENT_____; the right side of the Prolog headed Horn clause statement is called _____ANTECEDENT_____.

10) The process that works on all subgoals of a given goal in parallel is called ___BREADTH-FIRST SEARCH __; the process of finding a complete sequence of propositions (proof) for the first subgoal before working on others is called _DEPTH-FIRST SEARCH_.

11) The value of ___SYNTHESIZED__ attribute depends only on the values of the attributes on that node's children nodes; the value of ___INHERITED___ attribute depends on the attribute values of that node's parent node and those of its sibling nodes.

12) Ambiguity in grammars can be excluded by using 2 ways: ____REDEFINE THE GRAMMAR WITHOUT AMBIGUITY_____ or ____PROVIDE NEEDED INFORMATION OUTSIDE BNF__.

{ axiomatic, semantics, consequent, forward chaining, synthesized, semantic functions, type checking, Perl, resolution, denotational, backward chaining, Java, C++, depth-first, LISP, token, sentence, sentential form, syntax, antecedent, inherited, predicate functions, unification, breadth-first, instantiation, Prolog, terminals, nonterminals, lexeme, operational, attribute grammar, interpreting languages, compiling languages, BNF, Horn clause, parse tree, Von Neumann bottleneck, static semantics, left recursion, EBNF, PHP }

QUESTION TWO: **[11 pts]**

a) Given the following Prolog clauses:

```
what([],[]).
what([A],[A,A]).
what([A,B|C],[B,A|D]) :- what(C,D).
```

What will be printed by the Prolog interpreter in each of the following queries?

2 ?- what([e,p,c,e,e],L).

```
L = [p, e, e, c, e, e]
```

2 ?- what([b,a,2,1],L).

```
L = [a, b, 1, 2]
```

2 ?- what(K,L).

```
K = []
L = [] ;

K = [_G284]
L = [_G284, _G284] ;

K = [_G284, _G287]
L = [_G287, _G284] ;
```

6 b) Define a Prolog predicate **rangeR(I,K,L)** that creates a list containing all integers within a given range. It takes two integers **I** and **K** such that **I >= K** and returns a list **L** containing all consecutive integers from **I** down to **K**.

```
?- rangeR(9,4,L).
L = [9,8,7,6,5,4]
Yes

?- rangeR(71,67,Y).
Y = [71,70,69,68,67]
Yes

?- rangeR(1,7,Lst).
No

% rangeR(I,K,L) :- L is the list of all integers in the
%%interval I..K
% (integer,integer,integer_list)

rangeR(K,K,[K]).
rangeR(I,K,[I|L]) :- I > K, I1 is I - 1, rangeR(I1,K,L).
```

QUESTION THREE: Consider the following grammar and answer the questions below: [12 pts]

```
<S> → <S> op1 <G> | <G>
<G> → <Z> op2 <G> | <Z>
<Z> → <Z> op3 <M> | <Z> op4 <Z> | <M>
<M> → x | y | (<S>)
```

a) Which of the following strings have more than one parse tree? Mark the blank next to each string with either one only, or two or more. **Draw the trees on the sheet back.**

String	No. of parse trees
y op2 y op2 y	2
x op1 y op4 x	1

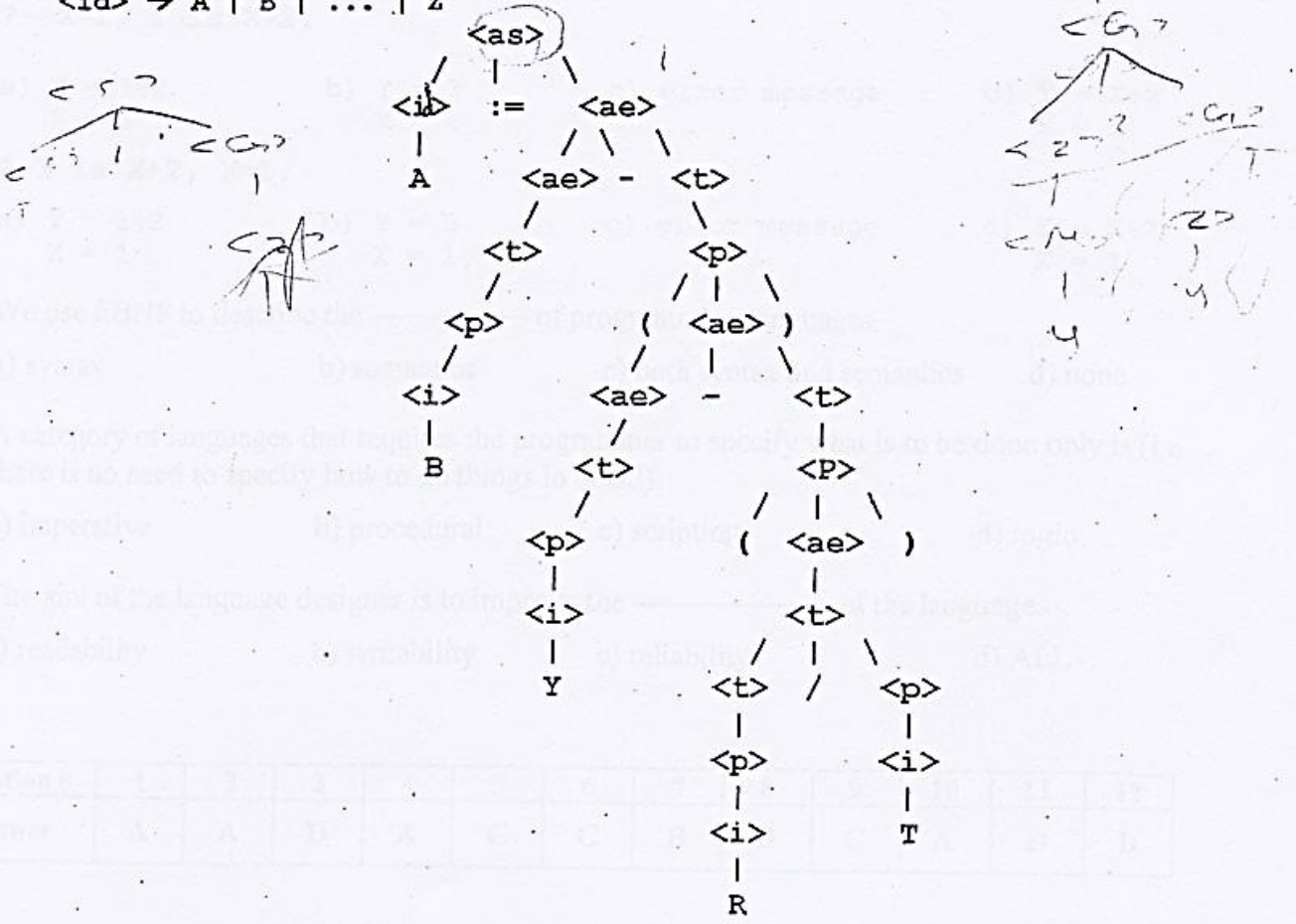
b) Convert the following BNF rules into equivalent ONE EBNF rule:

```
<const>  → <NonZero> <Digits>
<Digits> → <Digit> <Digits> | empty string
<NonZero> → 1 |2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
```

<CONST> → (1|2|3|4|5|6|7|8|9){<Digits> }

c) Consider the following grammar and construct the parse tree for the following assignment statement: **A := B - (Y - (R / T))**

```
<as> → <id> := <ae>
<ae> → <term>| < ae > + <term>| < ae > - <term>
<term> → <prim>| <term> * <prim>| <term> / <prim>
<prim> → <id> | <num> | (<ae >)
<id> → A | B | ... | Z
```



QUESTION FOUR: For each of the following questions, choose the BEST answer. [12 pts]

1) The applications that have simple data structures and require large number of floating point computations belong to _____ domain.

a) Scientific b) Business c) Web d) AI

2) With an unambiguous grammar, how many parse trees are there for any given string that is not in the language?

a) zero b) exactly one c) one or more d) infinitely many

3) `?- append(X,Y,[1,2,3]).`

a) `X = []` `Y = [1, 2, 3]` b) `X = [1]` `Y = [2, 3]` c) `X = [1, 2]` `Y = [3]` d) ALL

4) `?- Y=X+2, X=1.`

a) `Y = 1+2` `X = 1` b) `Y = 3` `X = 1` c) error message d) `Y = X+2` `X = 1`

5) `?- [1,2|X] = [1,2,3,4,5].`

a) `Y = 3+4+5` b) `X = [3,4]` c) `X = [3,4,5]` d) none

6) Perl is a language that is _____

a) interpreted b) compiled c) both a and b d) none

7) Demanding all type checking to be performed increases _____

a) readability b) reliability c) writeability d) ALL

8) `?- X=1, Y is X+2.`

a) `Y = 1+2` `X = 1` b) `Y = 3` `X = 1` c) error message d) `Y = X+2` `X = 1`

9) `?-Y is X+2, X=1.`

a) `Y = 1+2` `X = 1` b) `Y = 3` `X = 1` c) error message d) `Y = X+2` `X = 1`

10) We use EBNF to describe the _____ of programming languages.

a) syntax b) semantics c) both syntax and semantics d) none

11) A category of languages that requires the programmer to specify what is to be done only is (i.e. there is no need to specify how to do things in detail).

a) imperative b) procedural c) scripting d) logic

12) The aim of the language designer is to improve the _____ of the language.

a) readability b) writability c) reliability d) ALL

Question #	1	2	3	4	5	6	7	8	9	10	11	12
Answer	A	A	D	A	C	C	B	B	C	A	D	D